GSS 31: Another T Tauri star with an infrared companion*

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Using a rapid slit scan technique in the infrared (JHKL), the source GSS 31 (alias EL 22 or Do-Ar 24E), a T Tauri star in the Ophiuchus dark cloud, was discovered to be double at a projected separation of 1".95±0".10 (i.e. 320 AU). The position angle is almost exactly north-south. This is the second discovery of its kind, and the first in the southern hemisphere, the only previous case known being T Tauri itself (Dyck *et al.* 1982, Schwartz *et al.* 1984). The important point is that we were able to secure infrared photometry separately for both components while for T Tau the separation into two components was model-dependent due to their small separation (0."6). IR-photometry for the joint system GSS 31 had previously been obtained by Grasdalen, Strom & Strom (1973) and Elias (1978), while Chini (1981) obtained UBVRI photometry.

We find that the infrared companion of GSS 31 becomes brighter as wavelength increases from 1.6 μm to 2.2 μm, and dominates the optical component in flux at 3.6 μm (see Fig. 1). By integrating the dereddened energy distribution, we estimate a bolometric luminosity of 3.3 $L_{\odot}$ for the optical star and 0.9 $L_{\odot}$ for the infrared companion, using $A_V = 4$.

We have similar data on the binary PMS star Cham I (Glass 1979). This object is also double at a projected separation of 2."7, position angle roughly east-west.

Assuming both components formed at the same time from the same cloud, we can estimate individual masses and a mass ratio for these components in the following way: given the derived bolometric luminosity and an observed spectral type (KO for GSS 31; Bouvier, priv. commun.) we can place the optical component in an HR-diagram with PMS tracks and isochrones (see Cohen & Kuhi 1979). The infrared companion can also be placed into the HR-diagram according to its derived bolometric luminosity and the condition that it must lie on the same isochrone as the optical component (under the above assumption of identical age). Thus the masses of both components and therefore the mass ratio can be determined, provided the PMS tracks used are correct (the principle still applies even when better tracks become available). For GSS 31 we find M(optical) $\approx 1.5M_{\odot}$ and M(infrared) $\approx 1.0M_{\odot}$ from Fig. 7 in Cohen & Kuhi (1979).

*Based on observations obtained at the ESO 3.6m telescope, La Silla, Chile.

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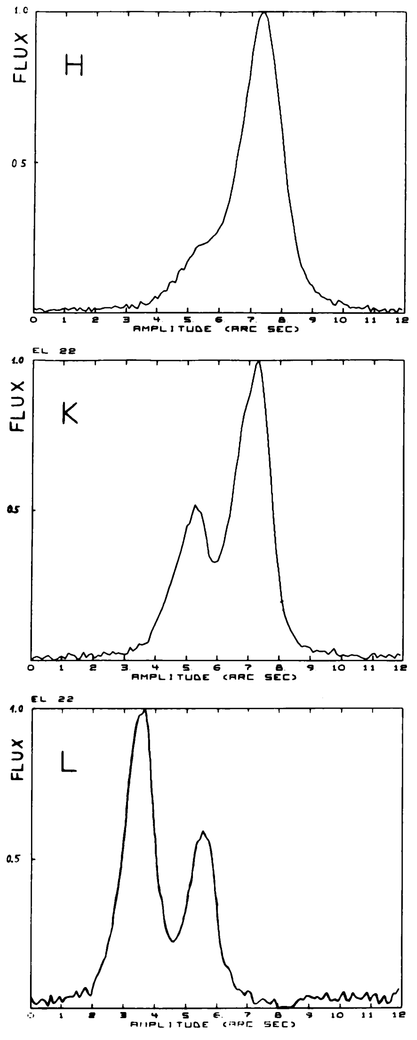

Fig. 1: Near infrared slit scans of the PMS-star GSS 31 (= EL 22) showing the binary nature of the object (projected separation ~ 2 arcsec).

References

Chini (1981). *Astron.Astrophys.* 99, 346.
Cohen & Kuhi (1979). *Ap.J. Suppl.* 41, 731.
Dyck *et al.* (1982). *Ap.J.* 255, L103.
Elias (1978). *Ap.J.* 224, 453.
Glass (1979). *MNRAS* 187, 305.
Grasdalen, Strom & Strom (1973). *Ap.J.* 184, L53 (GSS)
Schwartz *et al.* (1984). *Ap.J.* 280, L23.